ICA BASED SINGLE MICROPHONE BLIND SPEECH SEPARATION TECHNIQUE USING NON-LINEAR ESTIMATION OF SPEECH

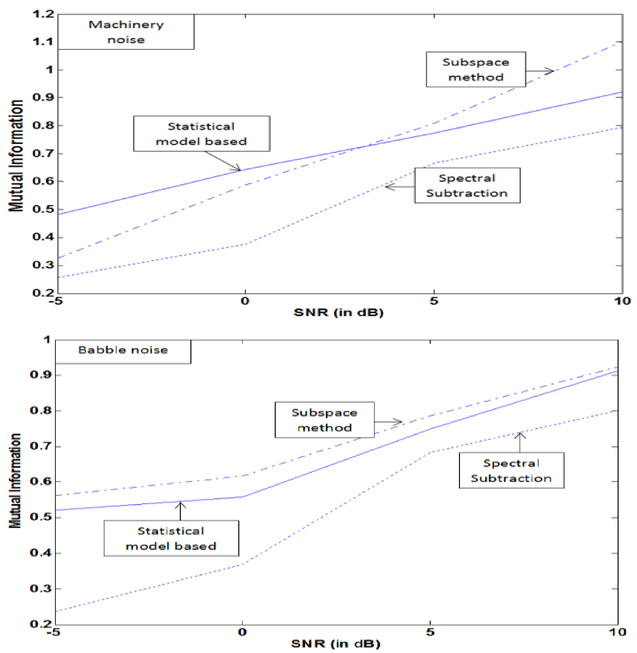
Chandan K A Reddy, Anshuman Ganguly and Issa Panahi
Statistical Signal Processing Research Laboratory(SSPRL)
Dept. of Electrical and Computer Engineering, University of Texas at Dallas, Richardson TX
http://www.utdallas.edu/ssprl/

1. MOTIVATION

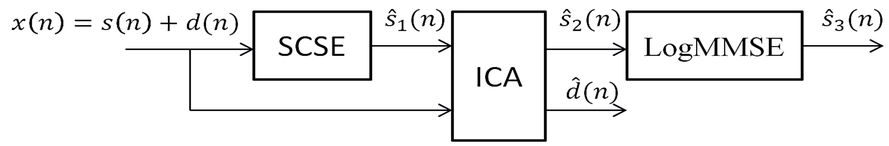
- Blind Speech Separation (BSS) using Single Microphone and Independent Component Analysis (ICA).
- From a single microphone input, we create 2 input signals to perform ICA for separating 2 sources of speech and noise.
- One input signal is the noisy speech signal.
- The second input is created by an initial estimate of speech from the noisy signal using a non linear estimator and minimization of mean square error of log magnitude spectrum.
- The two input ICA is then performed followed by a LogMMSE stage to obtain improved speech enhancement.

2. CHOICE OF SPEECH ESTIMATOR

- Determining which method of speech estimation is suitable for enhancing the performance of ICA by using mutual information

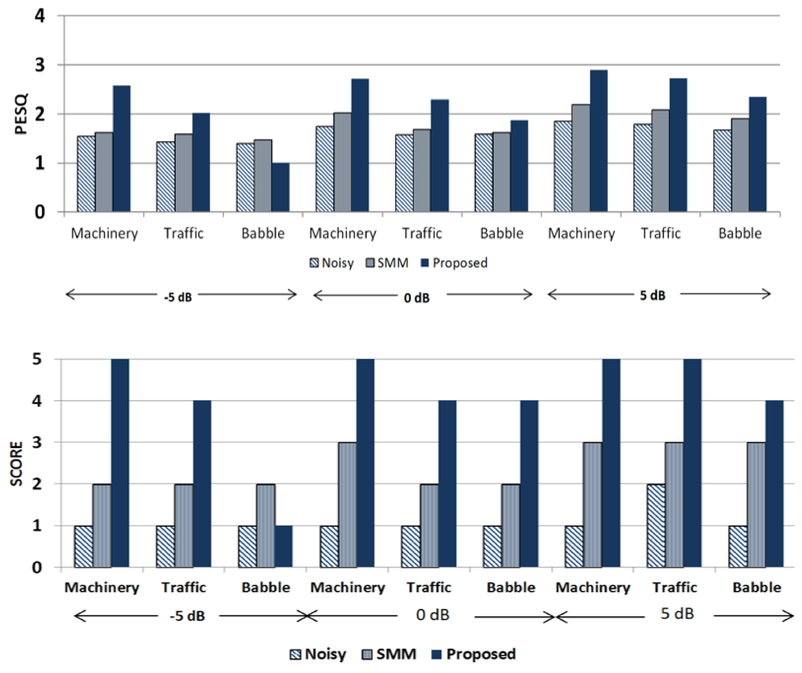


3. PROPOSED METHOD

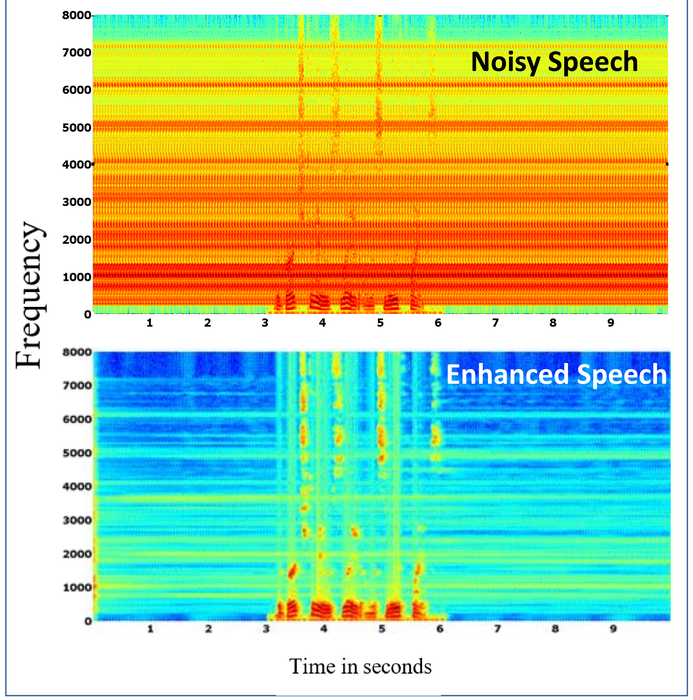


- We use our best choice of Single Channel Speech Enhancement (SCSE) to estimate speech and give it as one input to ICA and noisy speech as the other.
- This decomposition helps to preserve the integrity of speech from noisy speech $x(n)$.
- LogMMSE Speech Enhancement technique is used to reduce the residual noise in the second stage.

4. EXPERIMENTAL RESULTS



5. SPECTRAL COMPARISON



KEY REFERENCES

[1] S. Araki, S. Makino, H. Sawada, R. Mukai, "Underdetermined blind speech separation with directivity pattern based continuous mask and ICA," Signal Proc. Conf. 12th European, IEEE, pp. 1991-1994, Sept 2004.
[2] Liang Hong, Rosca, J., Balan, R., "Independent component analysis based single channel speech enhancement," IEEE Proc. Signal Proc and Infor. Tech (ISSPIT 2003). pp 522-525. 14-17 Dec 2003.
[3] P. Loizou, "Speech Enhancement: Theory and Practice", Boca Raton, FL: CRC Press, 2007.
[4] C. K. A. Reddy, Y. Hao and I. Panahi, "Two microphones spectral-coherence based speech enhancement for hearing aids using smartphone as an assistive device," 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), Orlando, FL, 2016, pp. 3670-3673.

ACKNOWLEDGEMENT

This work was supported by the National Institute of the Deafness and Other Communication Disorders (NIDCD) of the National Institutes of Health (NIH) under award number 1R01DC015430-01. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.